SPECIFICATION

TITLE OF THE INVENTION

NATURAL FEATHERED FIBER INSULATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an insulator using natural feathered fiber.

2. Detailed Description of the Prior Art

The conventional insulator, for example, insulator for construction is a material useful for reducing the air-conditioning load by preventing as much as possible the thermal transfer between building inside and exterior, preventing condensation on the inner wall surface, and moreover enhancing the feeling of comfort of habitant by approaching the inner wall surface temperature to an appropriate temperature. The housing insulation has been promoted by promulgating in 1980 the Notification No. 1 of the Ministry of International Trade and Industry and Ministry of Construction and the Notification No. 195 of the Ministry of Construction, based on the stipulations of the "Act concerning the Ratification of Energy Use" as housing energy-saving criteria, and these criteria were revised in 1992, the judgment criteria were published as No. 2 and the design and execution guideline as No. 451, these two Notifications are called, as a pair, "New energy-saving criteria", requiring more enhanced energy-saving actions.

As insulator for construction, for instance, rock wool, glass wool mat, plastic foam, mineral filled foam, or the like are used largely. In general these insulators

are classified by their material and shape, there are may kinds, and as mentioned above, the housing energy-saving is promoted and insulators presenting further excellent heat insulation performance are required by the market.

The present invention devised in order to respond to such market needs, has an object to provide an insulator presenting better thermal insulation performance than those of the prior art mentioned above. In addition, the conventional insulators for construction was incinerated or buried when disposed as waste. Some of them emit hazardous substance when incinerated and remain as they are in the earth without being decomposed when buried, and the present invention intends to supply an insulator for construction improved also in these respect.

In order to solve the aforementioned problems, the present invention has as the subject matter a natural feathered fiber insulator composed of natural feathered fiber as composition material by 1 to 99 weight %.

Also, the subject matter thereof is a natural feathered fiber insulator composed of natural feathered fiber by 1 to 99 weight % as composition material and formed by compounding synthetic fiber by 1 to 99 weight % as binder. Said synthetic fiber is characterized by being a core sheath composite fiber whose sheath portion is made of low melting point olefin and core portion is made of high melting point synthetic resin.

SUMMARY OF THE INVENTION

The present invention allows to form an insulator (and heat-retention material) presenting an excellent insulating performance, using natural feathers that are natural keratin protein, and processing them in fiber shape, in order to

taking profits of heat-retention, low density and volume, proper to feathered fiber. Synthetic fiber may be used as binder of feathered fiber, and an insulator mainly composed of feathered fiber can be formed by heat treatment of this synthetic fiber. Especially, when a composite synthetic fiber having core sheath structure is used, core portion remains in fiber shape after the heat treatment and gets caught in the feathered fiber, increasing the aperture rate in the insulator. The feathered fiber compounding rate may be different according to the use object; however, as feathered fiber is a natural organic substance, the more it is compounded, the less hazardous material is emitted when the waste insulator is incinerated, and the more it is biodecomposed in the earth, preventing the environmental pollution as much as possible.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 the manufacturing process of natural feathered fiber insulator according to the present invention;

Fig. 2 a schematic diagram of PP/PET core sheath composite fiber; and

Fig. 3 a schematic diagram showing a performance test apparatus of insulator.

DETAILD DESCRIPTION OF THE PREFERRED EMBODIMENT

Now, embodiment of the present invention will be described based on the attached drawings. Fig. 1 shown the manufacturing process of natural feathered fiber insulator, and first, natural feathers, for instance bird plumes used for a down quilt are degreased and washed with alcohol 1. Then, after drying, they are

processed into fibers of about 10 mm in length by a cutter having a screw form blade 2.

1 to 99 weight % of feathered fiber obtained by the aforementioned fiber shape processing 2 and 1 to 99 weight % of synthetic fiber as binder are compounded, and mixed so that both fibers become uniform 3. Feathered fiber 3 compounding rate is preferable 50 to 90%, however, it may differ according to the use object of the insulator, and is not limited.

Concerning synthetic fiber as binder, a core sheath composite fiber wherein the sheath portion is made of low melting point olefin and the core portion is made of high melting point synthetic resin, for example, a core sheath composite fiber (PP/PET core sheath composite fiber) formed into core sheath structure with polypropylene (PP) sheath portion and polyethylene terephthalate (PET) core portion as shown in Fig. 2 may be used. Otherwise, for instance, a core sheath composite fiber (PE/PET core sheath composite fiber) with polyethylene (PE) sheath portion and polyethylene terephthalate (PET) core portion, or ordinary PE fiber, PP fiber or other synthetic fiber can also be used. Considering the strength and performance of the insulating (heat-retention) material, PP/PET core sheath composite fiber is preferable.

Said feathered fiber and synthetic fiber (here, PP/PET core sheath composite fiber) are compounded uniformly and, thereafter, laminated to obtain a required density 4, and heat molded by a hot air dryer 5. This heat molding 5 is performed, for instance, by pinching the laminated material between upper and lower mesh conveyers and heating to a predetermined temperature by a hot air dryer or the like during the transportation. Almost no pressure is applied; however a convenient pressure may be applied as necessary.

During this heat molding, sheath portion PP of said core sheath composite fiber melts and acts as binder for adhering feathered fiber by points, core portion PET remains as fiber without melting, gets caught in feathered fiber, and is integrated by adhesion. Consequently, feathered fiber and core sheath composite fiber's core fiber get caught complexly, allowing to increase the whole aperture rate considerably.

Thus obtained mold uses insulator as main composition material, and this feathered fiber is a extremely light material as 0.026g/cm3 in specific volume, has a tubular hollow structure, presents a high aperture rate of the whole because of complex entanglement of feathered fiber and core sheath composite fiber's core fiber, allowing to obtain an extremely high insulation. By the way, the natural feathers are 0.000057cal/cm2 · cm · sec · ℃ in heat conductivity, which is extremely near the air heat conductivity of are 0.000057cal/cm2 · cm · sec · ℃ , making the heat insulation effect and heat-retention effect of the material high.

Next, in order to test the heat insulation performance of the natural feathered fiber insulator of the present invention, the head conductivity was obtained using a trial product obtained as mentioned above by JISA1412-2 "Measuring Method of Heat Resistance and Heat Conductivity of Heat Insulators-Part 2: Heat Flowmeter Method (HFM method)" Exhibit A (Provisions) Flat Plate Comparison Method. The test equipment thereof is shown in Fig. 3.

In this case, the dimensions of the natural feathered fiber insulator test piece is 200 x 203mm, the thickness 25mm, the density 34.1kg/m3, its heat conductivity λ obtained from the following formula 0.035W/(m · K), and its heat conduction can be obtained as 0.0301kcal/(m · h · ℃). The comparison with other insulation (and heat-retention) material is given in Table 1.

where, d: test piece thickness (m)

do: standard plate thickness (m) [=0.0252]

λo: standard plate heat conductivity [W/ m · K]

ΔT: test piece temperature difference (K)

ΔTo: standard plate temperature difference (K)

θ1: standard plate high temperature side surface temperature (℃)

θ2: both surface temperature between standard plate, test piece (℃)

θ3: standard plate low temperature side surface temperature (℃)

Besides, standard plate: polystyrene foam

test piece posture : horizontal

heat flow direction : vertical (downward)

[Table 1]

Insulator class	Heat conductivity	Kind of heat insulator
A-1		Glass wool for suction GW1, GW2
		Rock wool for suction 35K
		Siding board
A-2		Glass wool for housing 10K or equivalent
		Rock wool for suction 25K
		A class insulation board

B

Glass wool for housing 16K or equivalent

Bead method polystyrene foam No. 4

Polyethylene foam B grade

Tatami board

C

Glass wool for housing 24K, 32K or equivalent

High performance glass wool 16K, 24K or equivalent

Rock wool for housing (mat, felt, board)

Bead method polystyrene foam No. 1, No.2, No.3

Extrusion method polystyrene foam grade 1

Polyethylene foam grade A

Cellulose fiber fro suction 25K

Cellulose fiber fro suction 45K, 55K

(used with adhesive)

Phenol foam heat-retention plate grade 2 No.1

* Natural feathered fiber insulator

D

Bead method polystyrene foam Special No.

Extrusion method polystyrene foam grade 2

Phenol foam heat-retention plate grade 1 No.1, No. 2, grade 2 No. 2

E

Extrusion method polystyrene foam grade 3

Rigid urethane foam

Spray rigid urethane foam (foamed on site)

According to the aforementioned Table 1, the natural feathered fiber insulator according to the present invention belongs to the insulator class C (infinitely near class D), highest class among fiber base insulators, whose extremely high insulation effect was admitted. It is supposed that, as mentioned above, this is because of excellent insulation effect of natural plumes tubular hollow structure, the aperture rate improvement of the whole caused by a complex entanglement with feathered fiber as core sheath combined fiber is used as binder.

As mentioned above, according to the present invention, a fiber based insulator extremely excellent in insulation performance can be provided by using natural feathered fiber insulator as main component of insulator. Moreover, the aperture rate of the whole can be increased by entanglement with feathered fiber and the insulation performance can be improved remarkably, by using core sheath structure synthetic fiber as binder.

Moreover, as the feathered fiber is a natural organic substance, the emission of hazardous material is prevented as much as possible when the waste insulator is incinerated, and most of it is biodecomposed in the earth when buried, the remaining amount in the earth drops dramatically, preventing the environmental destruction, or other excellent effects can be obtained.